AGRONOMY NOTE

Plant tissue testing for boron

20 MULE TEAM BORAX™

Overview

- Plant analysis can be a valuable tool in determining the general nutritional status of crops during the growing season.
- Accurate interpretation of plant analyses data requires that plant tissue samples be carefully collected and handled prior to shipment to the laboratory.
- Knowledge of the normal boron sufficiency range in a given crop helps to interpret the analytical results and to diagnose a possible boron deficiency.

Plant analysis can be a useful tool in determining the general nutritional status of crops during the growing season. It is used along with soil testing to diagnose boron (B) deficiency symptoms because some visual symptoms can result from other factors, such as low or high moisture stress, abnormally low or high temperatures, insects and diseases.

The boron content of a plant, or one of its parts, also serves as a reflection of the available boron status of the soil for the period a few weeks prior to tissue sampling.

In plant analysis, the whole plant or particular plant parts are analyzed. The results of plant analysis are reported as precise numerical concentrations in the parts per million (ppm) range, which can be compared to previously established critical levels and sufficiency ranges.

Soil tests are strongly affected by certain soil properties, notably pH, organic matter content and texture. Soil test results may not be as definitive as plant analysis in verifying boron deficient soils, but soil test results can be helpful in interpreting plant analysis results.

Both diagnostic methods should be used together to effectively evaluate the soil-plant boron status and thereby confirm a sufficiency or insufficiency of boron for a given crop.

Collecting tissue samples

Plant sampling is frequently the most limiting factor in a successful plant analysis program. Extreme care should be taken when selecting the plant part to be sampled. There can be a large variation in boron concentrations among the different parts of the same plant.

Proper sampling requires that a definite plant part be taken, such as a particular leaf, a group of leaves, or a portion of a plant at a specified time in the plant growth cycle. Sampling instructions for several agronomic crops are given in Table 1. In timing your sampling regimen, use growing degree units (GDU). By sampling each year at the same GDU interval, you can build a consistent database of boron sufficiency to identify trends.

When specific sampling instructions are not given for a particular crop, the general rule is to sample the most recently matured leaves. Young emerging leaves, older mature leaves and seed are not considered suitable plant tissues for analysis since they do not usually reflect the current nutrient status of the whole plant.

The recommended time to sample many plants usually occurs just prior to the beginning of the reproductive stage.

Accurate analysis requires that plant tissue samples be carefully collected and handled prior to shipment to the laboratory. Elemental composition of plants varies with age, the portion of the plant sampled and other factors. Therefore it is essential to follow standard sampling procedures.

AGRONOMY NOTE: TISSUE TESTING

Table 1: Plant sampling instructions			
Plant species	**Stage of growth**	**Plant part to sample**	**Plants to sample**
Alfalfa or clover	1/10 bloom	Whole plant	40 - 50
Corn	8 - 12 inches tall	Whole plant	20 - 25
	12 inches to pretassel	Topmost fully developed leaf	25 -30
	Initial flowering	Leaf below and opposite ear leaf	25 -30
Cotton	Initial flowering	Upper mature leaves	25 -30
Peanut	Initial flowering	Topmost fully developed trifoliate	20 - 30
Soybean	Initial flowering to pod set	Topmost fully developed trifoliate	40 - 50
Wheat	Prior to or at early flowering	Topmost fully developed trifoliate	25 - 30

Handling tissue samples

Once the plants have been sampled, proper handling becomes very important. If the plants were dusty, dust the sampled plant parts off with a light brush or wash to remove contaminants (use distilled water if possible). Caution should be practiced as boron can be leached out of the sample by excessive washing.

To prevent spoilage of the plant material, the sample should be thoroughly air-dried (at 140-180 °F) prior to mailing to a laboratory for analysis. Fresh plant material will decompose rapidly when placed in polyethylene bags or in tightly sealed containers unless kept under refrigeration.

Place air-dried samples in a clean paper or cloth container and close the shipping container to avoid contamination.

When sending plant samples to a laboratory for problem diagnosis, also send a note describing the problem and the conditions under which the plants were growing (soil type and moisture situation, position on the landscape, cropping history, and fertilizers and chemicals applied for this crop).

Tissue samples taken from both normal and abnormal areas in the field can assist in the diagnosis of possible boron nutritional problems.

Interpreting analysis

The success of plant analysis as a diagnostic technique depends on the interpretation of the test results. The procedure used by many plant analysts is to compare the boron concentration in the plant tissue with the sufficiency range found in normal plants.

Deficient, sufficient, excessive, and intermediate levels of boron have been established by research. They can be used to interpret plant analysis results. Examples are shown in Table 2.

Even though it may be too late to make soil applications after boron deficiencies are diagnosed through plant analysis, it is important to recognize that a problem exists so that corrective fertilizer applications can be made for the next crop.

Low boron concentrations in plant tissues which were sampled prior to flowering and seed development can be corrected by prompt foliar spray applications of *Solubor*®.

Table 2: Deficient, sufficient, and excessive levels of boron in some plant species						
Plant species	**Plant part**	**ppm B in dry matter**				
		Deficient	**Low**	**Sufficient**	**High**	**Excessive**
Alfalfa or clover	Whole tops at early bloom	<20	20 - 30	30 - 80	80 - 100	>100
Corn	Whole plants at 8-12 inches	<5	5 - 10	10 - 25	25 - 50	>50
	Ear leaf at initial silk	<5	5 - 10	10 - 20	25 - 50	>50
Cotton	Leaf blade	<15	15 - 30	30 - 80	80 - 200	>200
Peanut	Upper mature leaf at bloom	<25	6	8	9	10
Soybean	Upper mature trifoliates at early bloom	<10	10 - 20	20 - 80	80 - 100	>100
Wheat	Whole plants at tillering	<5		5 - 20		

About U.S. Borax

U.S. Borax is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving our customers with more than 1,200 delivery locations globally. We supply around 30% of the world's need for refined borates from our worldclass mine in Boron, California, about 100 miles northeast of Los Angeles.

Our local agriculture experts understand the uses and benefits of boron on crops. In addition to a global sales team, we have a number of agronomists on staff to help fertilizer distributors maximize the benefits of borates in agriculture applications. Our ag team can answer individual growers' questions and concerns about their particular crop.

High quality, high reliability, high performance borate products. It's what we're known for.